

## WHAT IS CLAIMED IS:

## 1. A demodulator comprising:

(a) a quadrature controller fed with a signal quadrature-  
 detected by a quadrature detecting unit as an input signal to  
 correct a quadrature error between phases of an in-phase  
 component and a quadrature component of said signal based on a  
 5 quadrature error signal used for correcting said quadrature  
 error to output a corrected signal;

(b) an error detection unit detecting an error signal between  
 the in-phase component and the quadrature component of a  
 10 demodulated signal output by an automatic gain controller fed  
 with an output signal of said quadrature controller corrected  
 for quadrature error; and

(c) a quadrature error detection unit detecting the quadrature  
 error based on said error signal to feed the quadrature error  
 15 signal to said quadrature controller.

## 2. A demodulator comprising:

(a) a quadrature detecting unit fed with and quadrature-  
 detecting a quadrature modulated signal to output an in-phase  
 component and a quadrature component;

5 (b) a quadrature controller fed with the in-phase component and  
 the quadrature component output from said quadrature detecting  
 unit, said quadrature controller correcting the quadrature  
 error between the in-phase component and the quadrature  
 component based on an input quadrature error signal, and

10    outputting the resulting signal;

     (c)    an automatic gain controller fed with the in-phase  
         component and the quadrature component output from said  
         quadrature controller and outputting signals corrected for  
         amplitude errors based on the input amplitude error signal as  
15    the in-phase component and the quadrature component of a  
         demodulated signal;

     (d)    an error detection unit detecting, from the in-phase  
         component and the quadrature component of the demodulated signal  
         output from said automatic gain controller, an in-phase  
20    component of said error signal and a polarity signal of the  
         in-phase component of the demodulated signal, and a quadrature  
         component of the error signal and a polarity signal of the  
         quadrature component of said demodulated signal;

     (e)    an amplitude error detection unit generating an in-phase  
25    component and a quadrature component of an amplitude error  
         signal based on the in-phase component of said error signal  
         output from said error detection unit and the polarity signal  
         of the in-phase component of the demodulated signal, and on the  
         quadrature component of the error signal and the polarity signal  
30    of the quadrature component of said demodulated signal, to  
         output the generated in-phase and quadrature components of said  
         amplitude error signal to said automatic gain controller; and  
     (f)    a quadrature error detection unit generating a quadrature  
         error signal based on the in-phase component of the error signal

35 and the polarity signal of the in-phase component of said  
 demodulated signal, both output from said error detection unit,  
 and on the in-phase component of said error signal and the  
 polarity signal of the quadrature component of said demodulated  
 signal to feed the generated quadrature error signal to said  
 40 quadrature controller.

3. A demodulator comprising:

(a) an quadrature detecting unit fed with a quadrature  
 modulated signal as an input signal to quadrature-detect the  
 input signal to output in-phase and quadrature components of a  
 5 regular amplitude;

(b) a quadrature controller fed with the in-phase and  
 quadrature components output from the quadrature detection unit  
 to correct the quadrature error between phases of the in-phase  
 and quadrature components, based a quadrature error signal;

10 (c) an automatic gain controller fed with the in-phase and  
 quadrature components output from said quadrature controller to  
 output signals corrected for respective amplitude errors as  
 in-phase and quadrature components of a demodulated signal;

(d) an error detection unit detecting an in-phase component of  
 15 an error signal and a polarity signal of the in-phase component  
 of the demodulated signal, and a quadrature component of the  
 error signal and a polarity signal of the quadrature component  
 of the demodulated signal, from the in-phase and quadrature  
 components of the demodulated signal output from the automatic

20 gain controller; and

(e) a quadrature error detection unit generating a quadrature error signal based on the in-phase component of the error signal and the polarity signal of the in-phase component of the demodulated signal, and the quadrature component of the error  
25 signal and a polarity signal of the quadrature component of the demodulated signal, all output from said error detection unit, to feed the generated quadrature error signal to said quadrature controller.

4. The demodulator as defined in claim 2 wherein

said quadrature controller comprises;

a first low-pass filter fed with said quadrature error  
5 signal output from said quadrature error detection unit to smooth out and output said quadrature error signal;

a first multiplier multiplying the quadrature component  
output from said quadrature detecting unit with an output of said  
first low-pass filter; and

a first adder adding the in-phase component output from  
10 said quadrature detecting unit and an output of said first multiplier;

the quadrature component output from said quadrature  
detecting unit being directly output, an output of said first  
adder being output as an in-phase component corrected for  
15 quadrature errors.

5. The demodulator as defined in claim 3 wherein

said quadrature controller comprises;

a first low-pass filter fed with said quadrature error signal output from said quadrature error detection unit to

5 smooth out and output said quadrature error signal;

a first multiplier multiplying the quadrature component output from said quadrature detecting unit with an output of said first low-pass filter; and

10 a first adder adding the in-phase component output from said quadrature detecting unit and an output of said first multiplier;

15 the quadrature component output from said quadrature detecting unit being directly output, an output of said first adder being output as an in-phase component corrected for quadrature errors.

6. The demodulator as defined in claim 2 wherein said quadrature error detection unit comprises;

5 a second multiplier multiplying the in-phase component of the error signal ( $E_i$ ) output from said quadrature detecting unit with the polarity signal ( $D_q$ ) of the quadrature component of said demodulated signal;

10 a third multiplier multiplying the quadrature component of the error signal ( $E_q$ ) output from said quadrature detecting unit with the polarity signal ( $D_i$ ) of the in-phase component of said demodulated signal; and

a second adder summing outputs of said second and third

multipliers;

an output signal of said second adder being output as said quadrature error signal (Qd).

7. The demodulator as defined in claim 3 wherein said quadrature error detection unit comprises;

a second multiplier multiplying the in-phase component of the error signal (Ei) output from said quadrature detecting unit with the polarity signal (Dq) of the quadrature component of said demodulated signal;

a third multiplier multiplying the quadrature component of the error signal (Eq) output from said quadrature detecting unit with the polarity signal (Di) of the in-phase component of said demodulated signal; and

a second adder summing outputs of said second and third multipliers,

an output signal of said second adder being output as said quadrature error signal (Qd).

8. The demodulator as defined in claim 2 wherein said automatic gain controller comprises;

a second low-pass filter smoothing out and outputting the in-phase component of the amplitude error signal output from said amplitude error detection unit;

a third low-pass filter smoothing out and outputting the quadrature component of the amplitude error signal output from said amplitude error detection unit;

a fourth multiplier multiplying the in-phase component  
10 output from said quadrature controller as an input signal with  
an in-phase component of the amplitude error signal smoothed out  
by said second low-pass filter, said fourth multiplier  
outputting the result of multiplication as the in-phase  
component of the demodulated signal; and

15 a fifth multiplier multiplying the quadrature component  
output from said quadrature controller as an input signal with  
a quadrature component of the amplitude error signal smoothed  
out by said third low-pass filter, said fifth multiplier  
outputting the result of multiplication as the quadrature  
20 component of the demodulated signal.

9. The demodulator as defined in claim 3 wherein said automatic  
gain controller comprises;

a first absolute value computing circuit determining an  
absolute value of the in-phase component output from said  
5 quadrature controller;

a second absolute value computing circuit determining an  
absolute value of the quadrature component output from said  
quadrature controller;

a third adder adding together outputs from the first and  
10 second absolute value computing circuits;

a fourth low pass filter smoothing out an output of the  
third adder;

a sixth multiplier multiplying an in-phase component

output from said quadrature controller with an output of the  
15 fourth low pass filter; and

wherein the quadrature component output from the  
quadrature controller is directly output as the quadrature  
component, and an output of the sixth multiplier is output as  
the in-phase component of the demodulated signal.